

I claim:

1. A mechanical arm adapted to mount to a support and operative to move from a contracted state to an extended state, comprising:

(A) a base adapted to secure to the support and including a first fixed gear element disposed thereon;

(B) an elongated distal arm member having a first end portion and a second end portion opposite the first end portion and including a second fixed gear element disposed thereon;

(C) an elongated proximal arm member having a proximal end portion pivotally secured to said base for movement about a first pivot axis and a distal end portion pivotally secured to said distal arm member for movement about a second pivot axis;

(D) a drive shaft rotatably disposed on said proximal arm member and extending longitudinally thereof, said drive shaft including

(1) a first end portion provided with a first drive gear engaging said first fixed gear element, and

(2) a second end portion opposite said first end portion provided with a second drive gear engaging said second fixed gear element,

whereby rotation of said drive shaft rotates said first and second drive gears thereby to act respectively on said first and second fixed gear elements so as to pivot said proximal arm relative to said base and to pivot said distal arm member relative to said proximal arm member; and

(E) a drive associated with said drive shaft for selectively rotating said drive shaft relative to said proximal arm member.

2. A mechanical arm according to claim 1 wherein said base includes a first axle formed thereon to define the first pivot axis, the proximal end portion of said proximal arm member including at least one first bearing member sized and adapted to receive said first axle for pivotal movement thereon.

3. A mechanical arm according to claim 2 wherein said base includes a first knuckle having a first gap therein, said first axle defined by a first axle pin passing through said first knuckle to form oppositely projecting first trunnions, the proximal end portion of said proximal arm member including a pair of first bearing members sized and adapted to receive said first trunnions for pivotal movement thereon.

4. A mechanical arm according to claim 3 wherein said first fixed gear element is mounted to said first axle pin and is located in the first gap in said first knuckle.

5. A mechanical arm according to claim 1 wherein said distal arm member includes a second axle formed thereon to define the second pivot axis, the distal end portion of said proximal arm member including at least one second bearing member sized and adapted to receive said second axle for pivotal movement thereon.

6. A mechanical arm according to claim 5 wherein said distal arm member includes a second knuckle having a second gap therein, said second axle defined by a second axle pin passing through said second knuckle to form oppositely projecting second trunnions, the proximal end portion of said proximal arm member including a pair of second bearing members sized and adapted to receive said second trunnions for pivotal movement thereon.

7. A mechanical arm according to claim 6 wherein said second fixed gear element is mounted to said second axle pin and is located in the second gap in said second knuckle.

8. A mechanical arm according to claim 5 wherein said second axle is disposed on the first end portion of said distal arm member.

9. A mechanical arm according to claim 1 wherein said proximal arm member is constructed as a channel piece including a pair of side walls and a connecting wall extending therebetween to define an interior region, said drive shaft being located in the interior region.

10. A mechanical arm according to claim 9 wherein said connecting wall has a slot formed therein at the proximal end portion of said proximal arm member, said slot sized and adapted to allow said first fixed gear element to extend therethrough.

11. A mechanical arm according to claim 1 wherein said first and second drive gears are worm gears.

12. A mechanical arm according to claim 11 wherein said worm gears are each double enveloping cone drive worm gears.

13. A mechanical arm according to claim 1 wherein said drive includes an output shaft provided with an output gear, said drive shaft having a central portion and including a transfer gear disposed on the central portion for engaging said output gear.

14. A mechanical arm according to claim 13 wherein said drive is mounted to said proximal arm and wherein said output shaft extends transversely of said proximal arm.

15. A mechanical arm according to claim 1 wherein said drive is a motor.

16. A mechanical arm according to claim 15 wherein said motor includes a reduction gear box associated therewith.

17. A mechanical arm according to claim 1 wherein the ratios of said first and second fixed gear elements and said first and second drive gears are selected such that said distal arm member undergoes about twice an amount of angular movement about the second pivot axis when compared to the amount of angular movement of said proximal arm member about the first pivot axis.

18. A mechanical arm according to claim 1 including a foot member disposed on the second end portion of said distal arm member.

19. A mechanical arm according to claim 18 including a gimbal mount interconnecting said foot and the second end portion of said distal arm member.

20. A mechanical arm according to claim 1 wherein said distal arm member and said proximal arm member are of substantially common length.

21. A mechanical arm according to claim 1 wherein one of the first end portion of said distal arm member and the distal end portion of said proximal arm member includes a dog operative to provide a limit stop when said distal arm member and said proximal arm member are aligned with one another.

22. A mechanical arm adapted to mount to a support and operative to move from a contracted state to and extended state, comprising:

(A) a base adapted to secure to the support and including a first fixed gear element disposed thereon and a first axle disposed thereon to define a first pivot axis,;

(B) an elongated distal arm member having a first end portion and a second end portion opposite the first end portion and including a second fixed gear

element disposed thereon and a second axle disposed thereon to define a second pivot axis;

(C) an elongated proximal arm member including at least one first bearing member on a proximal end portion thereof that is sized and adapted to receive said first axle for pivotal movement about the first pivot axis and including at least one second bearing member on a distal end portion thereof that is sized and adapted to receive said second axle for pivotal movement about the second pivot;

(D) a drive shaft rotatably disposed on said proximal arm member and extending longitudinally thereof, said drive shaft including

(1) a first end portion provided with a first drive gear engaging said first fixed gear element, and

(2) a second end portion opposite said first end portion provided with a second drive gear engaging said second fixed gear element,

whereby rotation of said drive shaft rotates said first and second drive gears thereby to act respectively on said first and second fixed gear elements so as to pivot said proximal arm relative to said base and to pivot said distal arm member relative to said proximal arm member; and

(E) a drive associated with said drive shaft for selectively rotating said drive shaft relative to said proximal arm member.

23. A mechanical arm according to claim 22 wherein said base includes a first knuckle having a first gap therein, said first axle defined by a first axle pin passing through said first knuckle to form oppositely projecting first trunnions, the proximal end portion of said proximal arm member including a pair of first bearing members sized and adapted to receive said first trunnions for pivotal movement thereon.

24. A mechanical arm according to claim 23 wherein said first fixed gear element is mounted to said first axle pin and is located in the first gap in said first knuckle.

25. A mechanical arm according to claim 22 wherein said distal arm member includes a second knuckle having a second gap therein, said second axle defined by a second axle pin passing through said second knuckle to form oppositely projecting second trunnions, the proximal end portion of said proximal arm member including a pair of second bearing members sized and adapted to receive said second trunnions for pivotal movement thereon.

26. A mechanical arm according to claim 25 wherein said second fixed gear element is mounted to said second axle pin and is located in the second gap in said second knuckle.

27. A mechanical arm according to claim 22 wherein said second axle is disposed on the first end portion of said distal arm member.

28. A mechanical arm according to claim 22 wherein the ratios of said first and second fixed gear elements and said first and second drive gears are selected such that said distal arm member undergoes about twice an amount of angular movement about the second pivot axis when compared to the amount of angular movement of said proximal arm member about the first pivot axis.

29. A mechanical arm according to claim 22 including a foot member disposed on the second end portion of said distal arm member.

30. A mechanical arm according to claim 29 including a gimbal mount interconnecting said foot and the second end portion of said distal arm member.

31. A mechanical arm adapted to mount to a support and operative to move from a contracted state to and extended state, comprising:

(A) a base adapted to secure to the support and including a first fixed gear element disposed thereon;

(B) an elongated distal arm member having a first end portion and a second end portion opposite the first end portion and including a second fixed gear element disposed thereon;

(C) an elongated proximal arm member constructed as a channel piece including a pair of side walls and a connecting wall extending therebetween to define an interior region and having a proximal end portion pivotally secured to said base for movement about a first pivot axis and a distal end portion pivotally secured to said distal arm member for movement about a second pivot axis;

(D) a drive shaft rotatably disposed in the interior region of said proximal arm member and extending longitudinally thereof, said drive shaft including

(1) a first end portion provided with a first drive gear engaging said first fixed gear element,

(2) a second end portion opposite said first end portion provided with a second drive gear engaging said second fixed gear element, and

(3) a central portion between said first and second end portions, said central portion including a transfer gear disposed thereon,

whereby rotation of said drive shaft rotates said first and second drive gears thereby to act respectively on said first and second fixed gear elements so as to pivot said proximal arm relative to said base and to pivot said distal arm member relative to said proximal arm member; and

(E) a drive including an output shaft extending transversely of said proximal arm between the side walls of said channel piece, said output shaft

including an output gear disposed thereon and oriented to engage said transfer gear for selectively rotating said drive shaft relative to said proximal arm member.

32. A mechanical arm according to claim 31 wherein said base includes a first axle formed thereon to define the first pivot axis, the proximal end portion of said proximal arm member including at least one first bearing member sized and adapted to receive said first axle for pivotal movement thereon.

33. A mechanical arm according to claim 32 wherein said base includes a first knuckle having a first gap therein, said first axle defined by a first axle pin passing through said first knuckle to form oppositely projecting first trunnions, the proximal end portion of said proximal arm member including a pair of first bearing members sized and adapted to receive said first trunnions for pivotal movement thereon.

34. A mechanical arm according to claim 33 wherein said first fixed gear element is mounted to said first axle pin and is located in the first gap in said first knuckle.

35. A mechanical arm according to claim 31 wherein said distal arm member includes a second axle formed thereon to define the second pivot axis, the distal end portion of said proximal arm member including at least one second bearing member sized and adapted to receive said second axle for pivotal movement thereon.

36. A mechanical arm according to claim 35 wherein said distal arm member includes a second knuckle having a second gap therein, said second axle defined by a second axle pin passing through said second knuckle to form oppositely projecting second trunnions, the proximal end portion of said proximal arm member

including a pair of second bearing members sized and adapted to receive said second trunnions for pivotal movement thereon.

37. A mechanical arm according to claim 36 wherein said second fixed gear element is mounted to said second axle pin and is located in the second gap in said second knuckle.

38. A mechanical arm according to claim 35 wherein said second axle is disposed on the first end portion of said distal arm member.

39. A mechanical arm according to claim 31 wherein said connecting wall has a slot formed therein at the proximal end portion of said proximal arm member, said slot sized and adapted to allow said first fixed gear element to extend therethrough.

40. A mechanical arm according to claim 31 wherein the ratios of said first and second fixed gear elements and said first and second drive gears are selected such that said distal arm member undergoes about twice an amount of angular movement about the second pivot axis when compared to the amount of angular movement of said proximal arm member about the first pivot axis.

41. A mechanical arm according to claim 31 including a foot member disposed on the second end portion of said distal arm member.

42. A mechanical arm according to claim 41 including a gimbal mount interconnecting said foot and the second end portion of said distal arm member.

43. A method of providing and maneuvering a mechanical arm assembly relative to a base support, comprising

(A) pivotally attaching a proximal end portion of a first arm member to said base support whereby said first arm member may pivot about a first pivot axis relative to the base support;

(B) pivotally attaching a proximal end portion of a second arm member to a distal end portion of said first arm member whereby said second arm member may pivot about a second pivot axis relative to said first arm member; and

(C) mechanically driving said first arm member about the first pivot axis over a first angular range and simultaneously mechanically driving said second arm member about the second pivot axis over a second angular range that is about twice the first angular range.